

folk. They will hear, smell, and see him seconds, even minutes, before he has any chance of getting on terms with them."

Some people have spoken of the silence of the Indian jungles; but this is true only of the hotter part of the day, when most of the mammals and birds are taking their siesta. In the morning and evening, and at night, the jungles are full of sound.

The interrelations of living creatures are perennially interesting, and Mr. Stebbing gives some fine examples. Thus certain caterpillars, which he names, defoliate great blocks of teak forest, leaving them exposed to the hot sun and hot winds so that the undergrowth becomes scorched and withered. The deer and some other mammals have to quit these shelterless tracts.

"The termite has its uses in the Indian forest, for it rapidly disposes of the vast amount of refuse branches and dead fallen stems which without its aid would accumulate on the forest floor and greatly add to the risk of fires and increase their intensity when they took place, in addition to making progression impossible for man or beast."

The red ants are a source of great trouble to man, though he does make a paste of them which is eaten as a condiment with curry!

"The red ant lives in the trees and builds nests of the leaves. Such nests are a common sight in the sal forests. The nests are constructed in an ingenious manner, the edges of the green leaves being gummed together. The mature ant does not possess any material with which to perform this work. His gum bottle he finds in the immature ant, which has glands secreting a sticky substance. Several of the adult ants hold the leaves together, whilst another seizes a youngster between its mandibles and uses him as the brush of the gum bottle. It shows either a high form of civilisation or a low form of sweating to thus make the children share in the labour of house-building."

The second part of this interesting book deals with the means to be taken to preserve the forest game animals from poachers and unsportsmanlike sportsmen, and this in turn leads to the larger question of the preservation of the Indian land fauna as a whole. Some of the finest game animals are now within measurable distance of extinction, and the creation of game sanctuaries has been commenced with the view of affording protection to certain animals, such as the bison, rhinoceros, and deer. Apart from game, many components of the fauna are of economic value, and zoologically all are interesting. Mr. Stebbing pleads convincingly for large permanent sanctuaries, from which sportsmen, collectors, exploiters, and the like would be barred. One

almost feels as if Mr. Stebbing had seen St. Hubert's vision in the course of his book, for he becomes steadily less sanguinary and more of a naturalist. Nevertheless, it is very good reading through and through.

### Elementary Pure Mathematics.

- (1) *The School Geometry: Matriculation Edition.* By W. P. Workman and A. G. Cracknell. Pp. xi+348. (London: W. B. Clive, University Tutorial Press, Ltd., 1919.) 4s. 6d.
- (2) *Modern Geometry: The Straight Line and Circle.* By C. V. Durell. Pp. x+145. (London: Macmillan and Co., Ltd., 1920.) 6s.
- (3) *The Elements of Analytical Conics.* By Dr. C. Davison. Pp. vii+238. (Cambridge: At the University Press, 1919.) 10s. net.
- (4) *An Algebra for Engineering Students.* By G. S. Eastwood and J. R. Fielden. (With answers.) Pp. vii+199+xv. (London: Edward Arnold, 1919.) 7s. 6d. net.
- (5) *Elements of Vector Algebra.* By Dr. L. Silberstein. Pp. vii+42. (London: Longmans, Green, and Co., 1919.) 5s. net.
- (6) *Graphical and Mechanical Computation.* By Dr. J. Lipka. Pp. ix+264. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1918.) 18s. 6d. net.

(1) **T**HIS book is in reality sections i.-iv. of the authors' "Geometry: Theoretical and Practical," adapted to the requirements of students preparing for the matriculation and similar examinations. It combines the theoretical with the practical. After an introductory course of practical geometry based on intuition, there follows a series of propositions and theorems amounting, roughly, to "Euclid," Book I., Book III., Book II., and Book IV. The presentation and treatment call for no special comment; they are clear and concise, in the well-known style of the University Tutorial Series. There are many exercises of all kinds and of all grades of difficulty; many of the riders are provided with hints as to which theorems they are based on, and the student is thus led on to discover for himself the best methods for dealing with such exercises.

A few points deserve special mention. The definition of space on p. 34 is not likely to convey anything very clear or even intelligible to the average matriculation candidate. The theorem that the sum of the interior angles of a polygon of  $n$  sides is  $(2n-4)$  right angles is unnecessarily restricted to convex polygons. Another figure is required on p. 85. Some misprints and one or

two bad diagrams are but minor blemishes on this excellent guide for matriculation candidates.

(2) Mr. Durell's book on the modern geometry of the straight line and circle was intended as a new edition of his "Course of Plane Geometry for Advanced Students, Part I.," published in 1909. There have been, however, such considerable changes that the author has preferred to issue the book under a new name. It contains a pleasant and useful account of the geometry required by scholarship candidates at public and secondary schools, giving the usual work on rectilinear figures, similar figures, harmonic ranges, quadrilaterals and quadrangles, poles and polars, inversion, etc. There is a chapter on vector geometry with statical applications, while in dealing with inversion and coaxial circles the author very wisely makes use of analytical methods and notation. The treatment is sound, and the exercises are numerous.

(3) Many books exist dealing with analytical conics, and presumably every author of such a book aims at making the student interested in this eminently important branch of pure mathematics. Nevertheless, new books on the subject will continue to be scanned with anxiety by teachers of mathematics, because there can be no doubt that many students find the subject difficult, and the existing books scarcely afford them the help they need. One must say at once that Dr. Davison's book is no exception to the rule. It is a clear and sound investigation of the ordinary analytical theory of the straight line, circle, and conic sections, carried out on the orthodox principles and in the orthodox manner. The student who is desirous of learning the subject, and is intellectually and mathematically capable of following the argument, will no doubt study the book with profit, for there are very many examples, revision exercises, and a number of problem papers on the subject. The book is well produced and printed in the clear and interesting style that we have learnt to associate with the Cambridge University Press.

For a possible second edition we would recommend a few corrections and slight additions. In dealing with the distance of a point from a straight line, something should be said about the somewhat difficult question of the sign of the distance. There are *two* tangents to a circle, ellipse or hyperbola, having a given direction. The author assumes that the equation of a circle or conic is of the second degree; this assumption is not good pedagogics in a course of the kind he has produced. Is there any particular reason for putting the equation of an ellipse in the form  $b^2x^2 + a^2y^2 = a^2b^2$ ? The classical form with  $a^2$ ,  $b^2$

in the denominators looks simpler and is easier to remember. The director circle of a hyperbola appears to be subject to various vicissitudes, depending upon whether the real axis is greater or less than the imaginary axis; this should be mentioned. There are several misprints; the worst occurs where the co-ordinates of a point on a circle are called  $(a \cos \phi, b \sin \phi)$ .

(4) "An Algebra for Engineering Students" aims at giving all the knowledge of algebraic principles and processes that engineers should possess before commencing the calculus as applied to engineering. As a particular class of student is catered for, theoretical proof is in places made to give way to illustration and verification, and no one who has any experience of teaching mathematics to engineers will quarrel with the authors on this account. The subject-matter is the ordinary elementary algebra up to and including quadratic equations, and, in addition, indices, surds, logarithms, arithmetical progressions, ratio and variation are dealt with. Graphs and graphical methods are discussed in a competent manner, and the elementary use of the slide rule is explained. A few nomograms are included, but not in such a way as to afford the reader any real insight into their construction or use. The examples are of a practical type, but one cannot help remarking that the worked example on p. 3 is as artificial as any to be found in the "dry" theoretical books.

(5) Dr. Silberstein is an acknowledged exponent of vectorial methods, and anything that he writes on vector algebra bears the stamp of authority. The present book, although intended for optical computers who wish to use vector methods in optical computation, is equally useful to all who wish to read a clear and easy account of the elements of the subject. The ordinary processes of addition and subtraction, and of scalar and vector multiplication, with extensions, are dealt with first; then follows an account of linear vector operators, leading up to dyads and dyadics. Hints on the differentiation of vectors complete a useful little volume. The division of the book into chapters, and the addition of some examples of a practical nature, would increase its value manifold.

(6) Computation and graphical methods of calculation are assuming an increasing importance in mathematical teaching, especially for such students as are preparing to use their mathematics in some industrial or vocational application. Several universities and university colleges have instituted mathematical laboratories, and a book like Dr. Lipka's "Graphical and Mechanical Com-

putation" should be welcome to both students and teachers in such places.

The author has put into book form the course of lectures he has been giving to engineering classes in the mathematical laboratory at the Massachusetts Institute of Technology. It is a comprehensive course, including a discussion of various kinds of scales and the slide rule, networks of scales for several variables, nomographic charts, empirical formulas (with the method of least squares), periodic curves, interpolation, and approximate integration and differentiation (with various kinds of planimeters, integrators, integraphs, etc.). Each part of the subject is dealt with in some detail, with the result that the book is a mine of useful information on practically all the processes that occur in computational or graphical work. One may, perhaps, think that the subject-matter is too condensed both in treatment and in actual print, but as a foundation for a course in a mathematical laboratory the book can be recommended without hesitation; it should find a place in every mathematical and engineering or technical library, and serious students will find it a continual help in their industrial or research work.

A particularly exhaustive treatment from the practical point of view is given of nomography. Perhaps it would be better if the author had laid more stress upon explaining exactly how nomograms are to be constructed and used than upon the reproduction of so many nomograms. This is, however, a matter of taste, and what the author has put into this section of the book is on the same standard of excellence as the remainder. There are numerous examples, many of them worked out numerically in full. The book also contains accurate charts of uniform and logarithmic scales, as well as of square roots.

S. BRODETSKY.

### Our Bookshelf.

*Creative Chemistry: Descriptive of Recent Achievements in the Chemical Industries.* By Dr. Edwin E. Slosson. (The Century Books of Useful Science.) Pp. xvi + 311. (London: University of London Press, Ltd., 1921.) 12s. 6d. net.

THIS book is written by an American journalist with some knowledge of chemistry. It is intended for lay readers who wish to make themselves acquainted with some of the recent developments of applied chemistry, including nitrogen fixation, fertilisers, dyes, sugar, rubber, poison gas, and other subjects likely to be of interest to the average reader. The facts, which appear to be accurate and selected with care and discretion, are presented clearly and forcibly, with a certain

native humour. Gerhardt should not (p. 6) be described as a German chemist, while the account of the origin of Kekulé's theory of the benzene nucleus (p. 66) differs somewhat from that usually accepted. It is also interesting to know (p. 33) that "we might have expected that the fixation of nitrogen by passing an electrical spark through hot air would have been an American invention [it was discovered by the English chemist Cavendish], since it was Franklin who snatched the lightning from the heavens as well as our sceptre from the tyrant, and since our output of hot air is unequalled by any other nation."

*A Little Book on Map Projection.* By Mary Adams (Dr. William Garnett). New and revised edition. Pp. viii + 112. (London: George Philip and Son, Ltd.; Liverpool: Philip, Son, and Nephew, Ltd., n.d.) 5s. 6d. net.

THE second edition of this useful book differs little from the first, which was published in 1914, but the author's identity is now revealed. Most books on map projection are either severely mathematical or, at the other end of the scale, so trivial as to have little value. Dr. Garnett strikes a happy mean, and contrives to give within a modest compass practically all that a student of geography requires to know of this difficult subject. He wisely takes nothing for granted, and as he develops his subject gives ample explanation at each step. About half the book is concerned with the principles involved, and the remainder with the consideration of the principal projections. The subject is treated with a freshness and lucidity which result in a most readable book. The treatment of Sanson-Flamsteed's, Mollweide's, and Mercator's projections may be specially noted. There are a number of clear diagrams and a short bibliography. The book should make a strong appeal to teachers and students.

*Proceedings of the Aristotelian Society.* New Series, vol. xx. Containing the papers read before the society during the forty-first session, 1919-20. Pp. iv + 314. (London: Williams and Norgate, 1920.) 25s. net.

THE original papers included in this volume have already been noticed in the reports of society meetings. The present volume contains, in addition to the papers read at the ordinary meetings of the society, two of the symposia contributed to the Oxford Congress last September, in which the members of the French Philosophical Society took part. Of particular interest in this volume is Prof. J. A. Smith's sympathetic account of the philosophy of Giovanni Gentile, an Italian philosopher, the originality of whose speculation, already acknowledged in his own country, is beginning to be recognised universally. We may also mention as of special scientific interest Mr. A. F. Shand's article on "Impulse, Emotion, and Instinct," and Dr. Beatrice Edgell's article on "Memory and Conation." The volume is well up to the high level of the proceedings of previous years.